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What makes Napa Napa? The roots of success in the wine industry

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Abstract

California is world-renowned for the ability to produce world class quality wine. At the center of this achievement is the development of Napa as a premier wine producing region. We examine the sources of Napa's success by testing factors from leading industrial location theories against statistical and qualitative evidence. Using an unusual database of county-wide data on the wine industry to compare Napa's success with other wine-producing regions of California, we can control for different historical factors and economic conditions that temper most comparative wine studies. Many regions in California can produce world class wine, but none enjoy the same level of returns as Napa. Path dependency and distance to markets are poor explanations for the relative success of wine regions. We find that while *terroir*, or natural comparative advantage, has some evidence behind it, social capital and entrepreneurship behind technological leadership are central to Napa's competitive advantage.

Keywords: Wine industry; California; Industrial location; Regional economics; Economic development; Social capital; Entrepreneurship; Napa; *Terroir*

1. Introduction

The continual struggle for development on the local, regional, and national levels is one of the foremost concerns of any policy-maker. With development comes jobs, incomes, tax revenues, and citizen satisfaction. However, the mystery of what if anything the public sector can do to promote regional development remains unsolved. The question is especially pertinent as new competitors, from Australia to Argentina, have entered the global market for wine (Hira, forthcoming). This begs the question of what role public policy can play in promoting the local wine industry. In this article, we look closely at perhaps the most successful of the New World entrants, Napa Valley in California. Though universally recognized as a top wine producing region, there have been mainly descriptive and anecdotal explanations of Napa's success (Deutschman, 2003). This article examines the main perspectives behind industrial location theories for answers. It suggests that entrepreneurship and social capital explanations are as important as the mainstream wine industry explanation of *terroir*, in explaining Napa's, and by implication other wine clusters', success.

Porter's (1990) book *Competitive Advantage of Nations* re-introduced the term clusters to economic development specialists. In 2001 (p. 7) he defined clusters as "geographically close groups of interconnected companies and associated institutions in a particular field linked by common technologies and skills." The popularity of the term rests upon our everyday observances of agglomeration in the production of some goods, such as the fashion industry in Milan and IT in Silicon Valley. The same notions are omnipresent in the wine industry, where regional appellations are a primary branding instrument.

Cluster theory is still in an early stage, and there is no consensus around a precise set of causal concepts. Firms may be clustering initially for reasons related to the location of raw materials or demand markets. Once the clustering takes off, then other firms and skilled workers are attracted. If so, that would

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suggest that policy cannot play a role in creating clusters, only in promoting them once they are created by private companies. This is in line with the general notion that clusters can evolve through life cycles of death as well as birth (Feser, 2008, p. 198). However, most studies of clusters up to now have been static snapshots (Ter Wal and Boschma, 2009, p. 740).

The idea that locational advantage can be created through promoting clusters goes against the obvious fact that firms are driven by profit maximization, and so are unlikely to share valuable information with competitors (Turner, 2010, pp. 687–688). Yet, Bathelt et al. (2004, pp. 34–35, 48) point out that there are different layers of knowledge, from firm-specific to local tacit ("buzz") to global, which are transmitted through pipelines (globally-connected firms). Thus, we can appreciate the need for sharing at a higher level of abstraction, which would then be translated to and adapted for the specific firm's niche specialization. This idea would fit in with the need for highly specialised and flexible knowledge in the wine industry, and support the idea of knowledge as a collective or social good, supported by public institutions (Hira, 2013).

Nonetheless, if we think about specialised knowledge as a basis of cluster origins, it is hard to see how this could be maintained given that it is unlikely that knowledge will stay within a geographic region. Therefore, the most intuitive reason for wine industry location is *terroir*, that is the advantage of the natural characteristics within a wine region. *Terroir* is one of the central concepts of the wine industry, suggesting the particular qualities of wine depend on the climate, soil, weather, etc. and therefore creating a comparative advantage reflected in the geographically-based appellation system. The premise of this system is that only wines from Bordeaux can acquire the taste supposedly unique to that region. Given the differential performance of various wine clusters within California and an unusual availability of county level of data, we test out geographic *terroir*-based against knowledge-based sources behind cluster success.

2. The mystery of cluster location

There is no consensus around the boundaries of clusters, since production networks sometimes viewed as clusters can be global in reach (Boschma and Kloosterman, 2005, p. 2). A similar point is made about firms, in which personnel and backwards and forwards linkages are constantly in flux (Dicken and Malmberg, 2001, p. 351). Moreover, mapping out where the relevance of various supplier, buyer, and transportation/retail chains begins and ends seems a subjective exercise. Furthermore, the traditional measures of cluster networks, such as density and thickness of ties, have not been empirically related to the causal supposition that greater density must lead to improved outcomes (Taylor, 2005, p. 78).

In the wine industry, the problem of definition of boundaries is less daunting, as wine is generally optimally grown in an enclosed valley. Yang et al. (2012) find that wineries located more closely together in Washington State and California exhibit both higher wine scores and higher prices. Thus, it lends itself towards self-identification, which can later become regulated for reputational purposes, such as Napa Valley. Once the reputation for making fine wine (whether appropriate for all wineries or not) is established, we can see the multiplier effects of more tourists, new entrants, and knowledge depth and diffusion taking place. Yet physical properties do not a high quality cluster make in the wine industry. According to wine experts and ratings scales, the Central and Northern Coast and the Lodi region of California are as "fully capable of producing world class wine" as Napa (Rannekleiv, 2008). If we know that Santa Barbara Chardonnays, Lodi Zinfandels, and Sonoma Pinots are considered world class, why do not they share the same reputation (and price premium) as Napa? One place to start to answer this question is the common notion of path dependency, that is Napa simply came first and thus enjoys timing advantages. If that is the case, then there is little policy can do to create clusters. Policy can only come in later to support an existing cluster.

Boschma and Lambooy (1999) suggest an evolutionary approach where an industry may start by chance, but through agency, the local environment is re-shaped towards its needs. The combination of the more conducive environment including the presence of raw materials or markets and the presence of active agents "locks in" the industry to a certain area. Thereafter, a region can start to adopt a certain identity around a cluster, which in turn will attract more resources from both the public and private sectors (Romanelli and Khessina, 2005, pp. 355–356). The first explanation for cluster origins is historical accident, with propitious conditions creating momentum (path dependency) for the cluster.

As Menzel et al. (2010, pp. 3, 10) point out, what may seem to be an historical accident, when compared to other similar situations, while controlling for the context, can reveal a potential causal set of variables. For the moment, we simply do not know what those variables are. As they go on to state, "the question still remains how and why certain events trigger the emergence of a cluster in one region but not in another… Why a particular path is chosen and which processes influence if, how and why a new cluster adheres to establish development paths are questions still requiring further analysis."

For the wine industry, location is often explained by the broad category of *terroir*. *Terroir* in the wine industry refers to the combination of climatic, soil, and other growing conditions that supposedly give each location a unique stamp in terms of wine production. Appelation regulations aim to protect certain labels (e.g. champagne, burgundy) for wine produced from grapes in certain regions. Comparative geographic advantage is the foremost possible reason for cluster location since it is the foundation of economic thought about sources of competitiveness and the supposed source of high quality and differentiated wine.

By contrast, Graves and Waldman (1991) suggest that as technology improves, such as the development of air conditioning, people are drawn towards "amenities," such as nice climates and scenic surroundings. This helps to explain the historical movement of manufacturing to the South of the US. A parallel thread was later picked up to great effect by Florida (2002a,b), who celebrated the "creative class" such as designers and IT workers who seek out the nicest places to work, since they can

work anywhere. This suggests a possible strategy by cities to increase the "cool" factor through supporting artists will improve their economic prospects. Yet, it is hard to tell whether there is any causality behind San Francisco's high concentration of gay population and the IT sector. Those entering the wine industry frequently describe it as a "lifestyle" choice, as it attracts many retirees and wealthy individuals who have a passion for the product. Moreover, tourism is an integrally-linked industry to winemaking, thus location in a place where there is great scenery and/or other activities with close symbolic associations is desirable. The suggestion from Florida is that knowledge experts behind cluster success tend to locate in places that are attractive from a lifestyle perspective.

If we move from geographically-based to knowledge-based thinking, we begin to identify different potential causal factors. Dorenkamp and Mossig (2010, pp. 47–48) emphasize the crucial role of pioneer firms who enjoy first mover advantages but also take major risks in undertaking an enterprise new to an area. Clusters might also come from the location of innovation. Whether radical or incremental, the entrepreneur develops a new technique that is then further developed through implicit knowledge exchange and experimentation by imitators. If combined with a product cycle view, we could posit potential "windows of opportunity" when conditions are optimal for regional entry into a new business (Hira, 2012). The role of pioneering entrepreneurs who together work towards an innovation breakthrough could thus be another source of clusters.

The idea of innovation as a source of competitiveness overlaps with the notion that tacit knowledge and learning are the keys to cluster formation, maintenance and success. In practice, however, it is seemingly impossible to separate codified from tacit knowledge, though one could posit they also parallel core vs. applied firm activities (and global vs. local for multinationals) (Amin and Cohendet, 1999, pp. 91–92). The role of knowledge is particularly important in the wine industry. Though we commonly think of wine as a commodity with well-refined production processes, in fact, creating fine wine is a highly technical and dynamic skill. From cultivation of different grape strains, fertilization, watering, and soil choices, timing of ripening, dealing with a wide array of mold, mildew, and pests, to irrigation, temperature controlled fermentation, yeast strains, and marketing, the wine industry is continually upgrading. The entry of Australia and the US into global presence were enabled by intensive efforts at R&D, such as the development of steel tank fermentation, backed by strong research and training institutions such as the Australian Wine Research Institute (Hira, forthcoming). However, knowledge efforts go well beyond the science of wine towards the craft of unique tasting wines, as high-end prices are based primarily on a strategy of differentiation. Recent studies therefore emphasize the value of tacit, face-to-face knowledge in the adaptation of global technologies to local agricultural conditions for winemaking (Hira, 2013). The tricky part is that knowledge is disseminated globally in the wine industry through a wide variety of means, such as conferences and "flying winemakers" (consultants), but also developed locally. In the wine industry, access to global knowledge networks and developments appears to be at least as important as local entrepreneurship.

Giuliani et al. (2005, p. 550) remind us that even within clusters there are linkages to global knowledge and production networks. In a global world of competition, all firms need to keep up with innovations outside the cluster. Firms that can bridge the local and global are particularly important for cluster success. Yet, the willingness to share that knowledge varies dramatically in practice. Some firms are more likely to act as "external stars" than as gatekeepers. Thus, where the cluster is made up of large numbers of weak firms, she predicts that the few dominant firms will be more externally than internally-oriented, resulting is weak knowledge flows (Giuliani 2007, p. 163). Knowledge should therefore be seen as a club, rather than a collective good, and thus depends on firms seeing the payoffs in participation (Morrison and Rabellotti, 2009, p. 999). Morrison et al. (2012, pp. 78–79) suggest that there are two intervening variables that can be used to understand what role globally connected firms will take. The first is the level of "high-quality local buzz, which facilitates the internal circulation of knowledge, so that there is internal capacity for taking advantage of the knowledge brought into the system by global pipelines," and in cases where "the cluster is small and weakly endowed in terms of knowledge, so there are no internal substitutes for the learning opportunities coming from outside." Some authors, such as (Simmie, 2004, pp. 1110–1111) through an extensive survey of UK firms, suggest that there is no evidence that spatial proximity aids innovation. On the contrary, he contends, the most innovative firms are those that are globally connected. Another source of cluster competitiveness could be the interest of corporations with world class expertise ("global pipelines") who are instrumental to creating the knowledge base needed for success.

Social capital can thus be seen as a way to reduce economic transaction costs, including both the costs of information diffusion and of collective learning referred to as "buzz." Some authors go farther, suggesting successful regional integration systems require a conducive culture. By culture, they often refer to a shared history, a sense of shared values, but also tolerance for diversity to allow for new entrants and new ideas (Pilon and De Bresson (2003, pp. 27–28). Lorenzen and Foss (2003, pp. 90–91) suggest trust requires a set of "focal points" by which they mean a (tacit or explicit) code book with common strategies and tactics to solve shared problems. Thus, face-to-face access allows for the development of shared values, common perspective, and peer monitoring (including gossip) which draws the individuals together towards a common enterprise.

In terms of knowledge, clusters can be seen as dynamic networks for sharing information that leads to continual changes in industry structure to reflect experimentation and advances. Thus, social capital is seen as the inherent underlying foundation for cooperation to improve production processes. Lane (2002, pp. 77–78) points out that social capital does not spontaneously arise; some form of "scaffolding" is needed for the networks to gel. One type is the creation of social cohesion and introducing newcomers to existing

practices, such as regular shop talk meetings. The second are services to the businesses, from consultants to legal assistants. We could add to these more formal institutions, such as business associations and government support units, though they may arrive after incipient efforts at social organization. Institutions, then, can be seen as intermediaries, allowing for freer collusion, knowledge sharing, and trust building for longer periods than individual transactions and for more and new actors than just informal interactions. Local institutions and policies can thus be seen as conduits for knowledge creation and dissemination (Hira, 2013, forthcoming).

Yet, there are a number of reasons to be skeptical about a wine cluster deriving from a benign form of spontaneous friendly cooperation. Indeed emerging literature studying Chile and Italian wine clusters dispels the notion of clusters as benign cooperative networks designed around a collective enterprise when they are engaged in business activities to make profit (Giuliani, 2007). Rather, both the industry structure and the institutional configuration may, in fact, favor certain firms at the expense of others. On the other hand, the literature is unclear about whether inequality within a cluster has only negative consequences. For instance, large firms may provide, in a Coaseian sense, collective goods, such as R&D efforts that benefit other companies as they disseminate. They may have greater access to global retail and knowledge networks that allow the cluster to learn from best practices elsewhere (Preissl et al., 2003, pp. 206–207). Large firms can also act in a predatory fashion, to prevent new entrants from having an equal footing (Taylor, 2005, p. 73).

The important point is that clusters are filled with heterogeneous actors as well as continual churn of firms both entering and leaving the cluster. Proximity allows for a collective learning curve and improvement of the process (Steinle and Schiele, 2002, pp. 853).

We could postulate, then, that there could be two types of models for social capital explanations of cluster knowledge exchange as a source of competitive advantage. The first would be a monopolistic or oligopolistic one, in which a few anchor firms effectively provide collective goods for the cluster as appears to be the case in Chile. The second would be one in which there are multiple firms of equivalent size that create institutions to instill cooperation and collective learning. Our final category of explanations for cluster formation rests on social capital. The development of close personal ties helps move the actors towards collective gain, and advantage over individual efforts, through sharing knowledge.

3. Research approach

Cluster research that adds to theory is hard to conduct when basic terms are fuzzy. Though Porter (2000) offers a nice functional map, for example, of the California wine industry, including equipment suppliers, support institutions, and related tourism and food industries, filling this map in with actual actors would be an impossible task. Porter states (2000, p. 17) that "Drawing cluster boundaries often is a matter of degree and involves a creative process informed by understanding the linkages and complementarities across industries and institutions that are most important to competition in a particular field. The strength of these "spillovers" and their importance to productivity and innovation often are the ultimate boundary-determining factors." Porter goes on (2000, pp. 22–23) to explain that clusters create productivity through a variety of channels, such as shared complementarities. For example, wine producers in the same area can promote tourism through joint marketing and geographical proximity. Proximity also can help in improving productivity and learning through competition with local rivals. Clusters also improve the possibility for perceiving new technical, operating, or retail possibilities by sharing information with like-minded firms. Because of these needs for information, policy can play a role in facilitating coordination (Porter, 2000, p. 30). Motoyama (2008, pp. 357–359) points out that this reasoning could be seen as tautological. Regions do not define strategies, firms do. If productivity leads to competitiveness, it begs the question of what leads to productivity? We are equally unclear about what constitutes strong versus weak ties. Knowing that there are a few successful clusters does not mean that cluster policies are going to be effective. Clusters could be effective for reasons that we do not have control over. Until there is a clear causal relationship between interconnection and competitiveness, the theoretical foundation of clusters will remain shaky.

Stimson, Stough and Roberts (2006, pp. 244–245) note four basic problems with cluster policy and research. The first is the tendency to prescribe policies without identifying more clearly what are the causal relationships and key components and actors within a cluster. The second is problems of identifying the cluster, as is common in regional analyses, through quantitative techniques without linking them to policy actions. The third is to conflate clusters with particular industries. Clusters include related industries and both upward and downward linkages. The last is to focus exclusively on a formal approach to clusters, such as input–output modeling, while ignoring the more informal aspects of a cluster, such as institutions and conventions.

Many studies also compare clusters in different industries in the same volume (Karlsson and Charlie, 2005). This approach is evidently problematic because it does not unpack the potential policy variables or link them to the creation and growth of clusters. While interesting, it ignores the fact that different industries have different cluster characteristics and firm level strategies (Pietrobelli and Roberta, 2005, p. 34). We would not expect wheat to have a cluster, and certainly not the same geographical concentration as the fashion industry for instance. Thus mixing industries confounds the ability to draw out theoretical conclusions. The same issue comes up with comparing clusters in radically different areas, where both geography and contextual variables might further confuse any comparison. For example, comparing post-Soviet oil agglomerations with those in Saudi Arabia would seem to be like comparing apples and oranges given the vastly different political and historical contexts of the industry in each place. Therefore, this study controls for industry, by selecting wine, and for geography and context, by examining clusters within California. It is important, in sum, to keep in mind one of the usual properties of the wine vs. most other industries, namely

that pricing mechanisms are not precise signals given the partly subjective and sometimes shifting nature of quality.

We set up the following hypotheses to test out as explanations for cluster formation:

H1: Historical accident (Timing)
H2: Comparative geographic advantage based on proximity to markets and/or *terroir*
H3: Pioneering entrepreneurs
H4: Actors with global knowledge and/or connections
H5: Social capital

We conduct a data analysis examining the relative performance of different clusters within California, to see if there is a correspondence between Napa's success and each of these hypotheses. Identifying key areas for wine production is not as straightforward as it should be in California. Unlike France, for example, in the US, American Viticultural Areas (AVAs) which date from 1978 are based on the idea that soil and climatic conditions vary from one location to another, but are not regulated in regard to types of grapes or farming or production techniques. There are a number of AVAs that are smaller than counties, so the overall size varies considerably. Moreover, the definition of the boundaries for AVAs has unsurprisingly been controversial, and a number of wineries not in the premier districts use blends of grapes from different areas (Guthey, 2004, pp. 13–14, 9). There are no datasets attached to AVAs of which we are aware. Although there are some very limited data based on California grape growing districts as we discuss below, extensive data is only available on a county basis. Therefore, we match up each area to the appropriate counties covered by the grape growing districts. With a few exceptions where counties are divided, this works well. The data show that there are major differences across California in terms of wine production performance. The USDA's California office has posted records on grape harvests from 1991.

4. Origins of success of Napa are mysterious

4.1. Importance of California in US wine production

The US wine industry offers a fascinating possibility for comparing cluster life cycles over time, in order to understand what effects, if any, policy interventions can have in promoting clusters. Going by the list of American Viticultural Areas, wine is produced in 32 different US states. The wine industry is dominated by California production, where 89% of all US wine is produced (Table 1).

As we can see from the above totals, New York and Washington State are the only other significant producers, and they together produce less than 8% of that total. See Hira (Forthcoming) for in depth studies of the New York, North Carolina, Oregon, Virginia, and Washington state wine industries.

Table 1
State production of bulk wines, 2011 annual.
Source: Department of Treasury, over 1 m gallons.

State	Gallons	%
CA	605,619,613	88.6
NY	25,183,355	3.7
WA	24,656,796	3.6
OR	5,479,533	0.8
VT	3,356,568	0.5
KY	2,196,055	0.3
FL	1,920,638	0.3
OH	1,568,378	0.2
MI	1,540,149	0.2
NJ	1,507,311	0.2
NC	1,381,370	0.2
MO	1,163,179	0.2
IN	1,122,617	0.2
VA	1,062,479	0.2
Others	5,865,226	0.9
US Total	683,623,267	

4.2. Napa's superior performance

Ideally, we could develop a dependent or performance variable based upon profitability of a region; however, there are no such data available by region. Even if one were to try to assemble a dataset based on individual companies, many are privately owned or parts of larger entities. Therefore, we have to resort to more indirect measures. We can use USDA data to rank order the average returns to California growers of wine grapes by district. *These returns are a proxy for the relative success of the winemakers in that district*. As we can see, Napa has by far the highest returns (approx. $3600/ton), with Sonoma trailing far behind (approx. $2200). A second group lies between $750 and $1500/ton, and a third group hovers around $500/ton (Fig. 1).

It seems obvious to state that regional appellations are more valuable if they lead to higher priced wines. However, doing an analysis purely by price is problematic for the obvious reason that lower priced wines do not appear in most on-line sites, including *Wine Spectator*. An attempt to find a list by grocery chains also met with frustration, as they do not publish comprehensive price lists. Some on-line wine sales sites do have some lower, if not the lowest priced wines. On these sites, at the low end, wines are often blends of grapes, listed as California wines, and therefore it is impossible to trace out differences across regions. We therefore examined an on-line wine seller for California wines priced above $80, the highest category. On May 25, 2013, there were 163 wines listed (Fig. 2).

Notable is the fact that of the 31 wines for Sonoma, 8 were from Russian River Valley. Within this dataset, fully 91% was red wine, with white constituting 8% and champagne and sparkling wine 1%.

Fig. 3 demonstrates that Cabernet Sauvignon is by far the most important varietal for achieving high wine prices in California. Among the smaller subset of white wines, Chardonnay predominates, accounting for 75% of high-priced white wines.

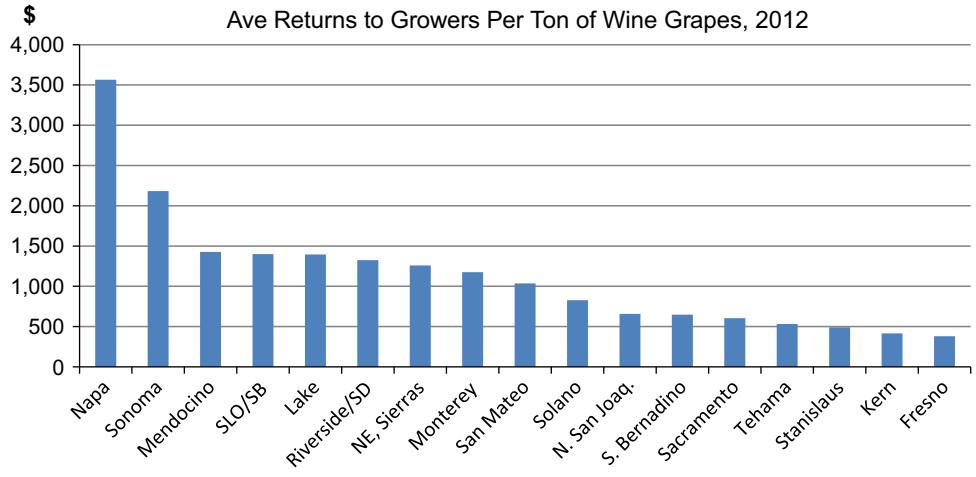

Fig. 1. Napa grapes are more valuable.
Source: Author calcs from USDA, NASS.

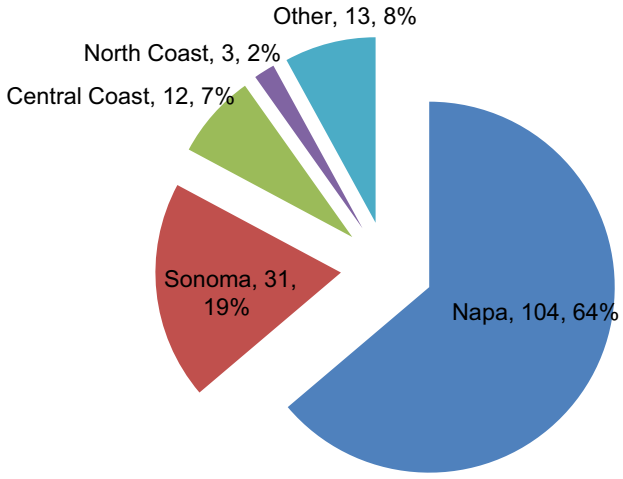

Fig. 2. California price premium wines by region.

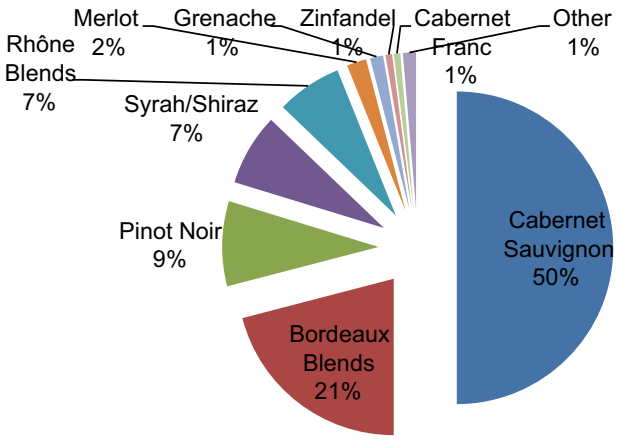

Fig. 3. Varietal breakdown of California premium wines.

Our analysis is close to the price effects that Bombrun and Sumner (2003, p. 1, 5) found in creating a database of 8460 observations of new release wines listed in the *Wine Spectator* from 1995 to 2001. They found that, relative to the generic California appellation, the top regional appellation values were Oakville (Napa) with $8.91 in premium; Sonoma Mountain with $8.36; and Napa Valley with $5.99. Among others, Paso Robles came in at $2.99; and Mendocino at $2.91.

Thus, we are left with the question, why does wine from Napa Valley enjoy such a major price premium over the rest of California, particularly areas that can produce equally high quality wines?

4.3. Quality Is NOT the only answer

The most obvious explanation for the price premium is that Napa is producing higher quality wines. Investigating such a notion is not as straightforward as it might seem, since wine is sold by individual producers, not by region. Furthermore, we recognize that there are likely to be differences across micro-regions. For example, Benjamin and Podolny (1999, p. 574) find in a statistical analysis that Sonoma County and two smaller sub-appellations in it, Alexander Valley and Russian Red River Valley, rank above Napa. As they readily admit, it is hard to view status rankings based on reputation as measured by expert panelists or through *Wine Spectator* ratings as precise. Not only are they continually changing, but as wine is judged at the firm level, there could be important variability within a region. Nonetheless, they find that region clearly does matter in terms of both ratings and price consistently over time, suggesting that regions do clearly have effects on firm possibilities for producing high quality, high price wine. This suggests, in turn, a "lock in" for regional clusters, since once a higher price is achieved, more capital is available to invest further into the business and further improvement (pp. 585–587). Sang Kwon et al. (2008, pp. 17–18) also find, using *Wine Spectator* rankings, that higher ratings, age, and AVA and county appellations all positively affect California wine prices, though the intensity varies over varietal and AVA. The largest effects are for Napa (especially Cabernet Sauvignon), Sonoma, and Monterey, and the lowest for the broadest appellations of Central Coast, North Coast, and California. Moreover, there is a large amount of jug and boxed wine, from central California that would not be reviewed in *Wine Spectator*, therefore such an

analysis would be limited. Yet, it is a well known fact in the wine industry that in individual blind tastings, the higher priced wines are not consistently chosen as better quality wines. This makes us wonder if reputation rather than tasting quality is the key to success.

In fact, despite the clear Napa price premium over its closest regional competitor, Sonoma, a wide number of long-term studies show that quality ratings put Napa and Sonoma wines as quite close. For James Laube's study of Cabernet Sauvignon vintages from 1980 to 1986, there was just an average one point difference in quality. A number of contemporaneous studies of Chardonnay ratings put Sonoma ahead by an average of less than one point (Sullivan, 2008, pp. 426–427). We could add to this the fact that 90 point super premium quality wines are produced on an individual basis in a number of California regions, from Mendocino to Santa Barbara to Lodi in the Central Valley. This alone throws a wrench into *terroir* as a source of wine quality. We do not throw out *terroir* as unimportant, as there clearly is a difference in the quality of the wine grapes that can be grown in large parts of the mass production Central Valley as opposed to the more renowned producing areas. *But terroir only provides a baseline for where decent wine grapes can be grown; it does not explain why many wineries within the same terroir produce differential qualities of wine, or more importantly why individual wineries in less renowned regions can produce super premium wines.*

This conclusion is backed by several recent studies that could not find a strong link between site characteristics in Bordeaux and Oregon and the price or quality ratings of wine. The studies therefore conclude that *terroir* price premiums are based as much on consumer perception and branding as on actual differences (Gergaud and Ginsburgh, 2010; Cross et al., 2011).

We have seen that Napa quite clearly enjoys a price premium in Cabernet Sauvignon, notwithstanding the fact that other regions are able to produce fine wines. This suggests that price is related to regional reputation + varietal specialization. All of the super premium Pinot Noirs listed above, for instance, are from Sonoma County/Russian River. The common linkage of the region of Bordeaux with certain types of red wine reinforces this point. Our exercise underscores the value of consistency and therefore the fact that wine pricing is a collective achievement. This furthers the points made elsewhere (Hira, Forthcoming) that across the world high quality wine regions are specialised in their knowledge, and generally count on reputations related to certain varietals.

H1. Timing/path dependency is no explanation.

For cluster theorists, timing is important because early entry into an industry can create advantages in learning and in establishing locational advantage. There appears to be no real difference in the timing of the start of the wine industry across California, which dates back to the 18th century, and actually began in Southern California with the arrival of Spanish priests. The first wine was reportedly made in 1769 at the San Diego Mission. The wine was based on local grapes of very poor quality. The culture spread throughout Southern California picking up steam from the Gold Rush. In 1848 the state population was 4000; by 1852, it reached 250,000 (Colman, 2003, p. 100). California's first commercial winery began in Los Angeles in 1824. By the middle of the nineteenth century, Los Angeles was known as the City of Vines; by 1860 it had more than 1 million vines. As San Francisco was the economic engine of the state, most wine and fresh grapes from Los Angeles were exported there or to the eastern United States. Jean Louis Vignes was a pioneer who arrived from Bordeaux in Los Angeles in 1831. Despite this head start, the industry in Los Angeles collapsed at the turn of the twentieth century. There are several reasons for this. The first was the use of the local Mission grape which produced poor quality wine. The second was growing competition from Northern California. There were 175 vineyards in Napa in 1886, and 932 vineyards in Sonoma in 1893, spurred on by wealthy investors from San Francisco. Napa had a reputation for producing good quality grapes, even back then, with a focus on Riesling and Zinfandel, and for producing sherry and port. Its leading wineries were led by wealthy families: Beaulieu by French emigré Charles de Latour; Inglenook by Finnish sea captain Gustav Niebaum who made a fortune in the Alaskan fur trade. Cesare Mondavi was able to send both his sons to Stanford. The wine was shipped in bulk to wine merchants in San Francisco who stored and bottled it. The third was growing competition for land from other types of agriculture as well as real estate. The fourth and perhaps most important was the virulent Anaheim (Pierce's) disease, which was a bacterially-based plague. This coincided with an outbreak of phylloxera in 1873. The end result was a collapse of the industry in Southern California (Curry III, 1994, pp. 73–76; Colman, 2003, p. 100; Guthey, 2012, pp. 183–184; Heyhoe and Hock, 2004, pp. 34–35, 27). In short, what we see is that there is no historical timing that explains Napa's advantage.

H2. Natural locational advantages: new economic geography and comparative advantage explanations are limited.

5. Natural comparative advantage explanations

In Napa, costs are higher—the economies of scale are better for other counties, as reflected in grape prices. Fig. 4 shows Napa is in the middle in terms of harvested acreage.

Yield per acre in tons also shows that other parts of California are more productive than Napa (Fig. 5).

5.1. Land far more expensive in Napa

If we examine land prices by county in California, we see that outside of San Francisco, and surrounding areas of it and LA, the value of farmland/acre is higher in Napa and Sonoma by far than anywhere else (Table 2).

Despite the huge difference in land prices, about 1/3 (300) of California's wineries are located within Napa (Heien and Martin, no date).

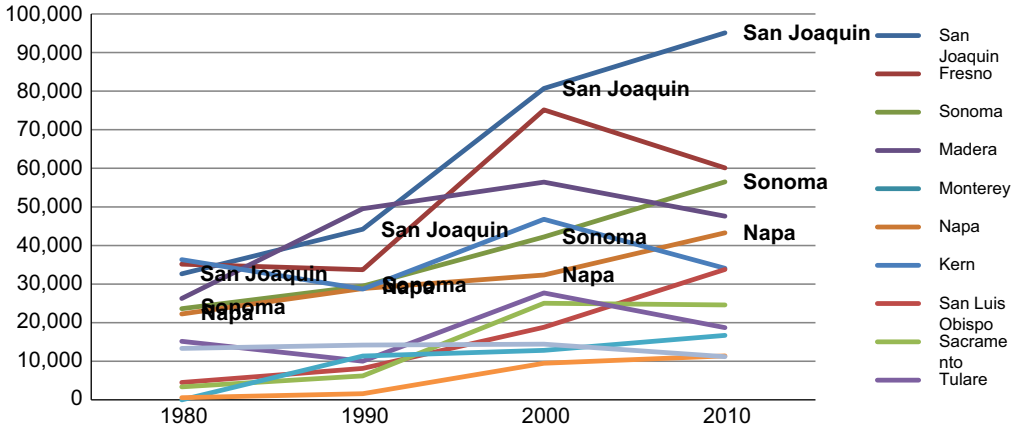

Fig. 4. Harvested acreage by county.

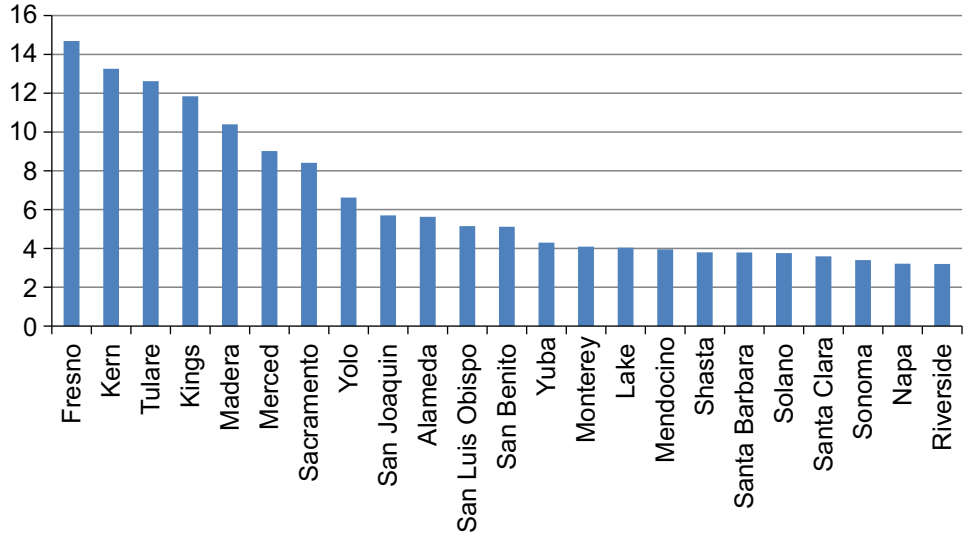

Fig. 5. 2010 Yield (tons)/acre.

5.2. Weather

There is a growing literature that links wine prices to weather (Ashenfelter, 2008; Byron and Ashenfelter, 1995). Ramirez (2008) finds that weather, specifically temperature and precipitation, also affects quality ratings and prices in his study of Napa wineries from 1970 to 2004, though he notes that the relationship for ratings is relatively weak. As Tables 3 and 4 demonstrate, it is hard to find a clear weather advantage to Napa as opposed to other areas of California. It could be that weather has a far more complex relationship to wine quality, but there is no theory to guide us further. That would leave soil, for which we have no systematic data. Indeed, the main idea in the wine industry is that *soil varies from one particular area of land,* i.e. *one winery, or even within one winery, to another. Thus if soil is responsible, it would not explain regional price advantages.*

In order to further test the marginal effects of weather, especially given the positive results of Ashenfelter (2008) for higher Bordeaux prices being related to hotter, drier summers, we developed a comprehensive model of value per acre for wine grapes using yearly data from 1980 through 2011. We also included the independent variable of the number of wineries, in order to test out the social capital hypothesis, as we discuss further below. We carried out a panel (longitudinal) analysis based on 932 observations (after the removal of a few suspicious data points) corresponding to the following linear model:

$$y_{ij} = \beta_0 + C_i + Y_j + \beta_1 W_{ij} + \beta_2 P_{ij} + \beta_3 T_{ij} + \varepsilon_{ij}$$

where

- y_{ij} is the value per acre in dollars for county i in year j;
- β_0 is the intercept term which corresponds to the baseline case of Alameda in 1980;
- C_i is the county term for the i-th county where there are 34 counties;
- Y_j is the year term for year j where the years range from 1980 to 2011;
- W_{ij} is the number of wineries corresponding to county i in year j;
- P_{ij} is the total daily precip (Apr–Sept) for county i in year j relative to the historical mean;
- T_{ij} is the mean daily min temp (Apr–Sept) for county i in year j relative to the historical mean; and

– ε_{ij} are independent normally distributed error terms with mean 0 and constant variance

Notes: We experimented with alternative models including the systematic investigation of Box–Cox type transformations on both the response variable y_{ij} and the continuous independent variables W_{ij}, P_{ij} and T_{ij}. For each model, we examined the R-squared value and corresponding residual plots. We also attempted to seek a balance between interpretability of terms and model fit. For example, we prefer the mean daily minimum temperature variable T_{ij} over the parametrization $T_{ij}^{0.93}$. The model presented above is the preferred model based on these criteria. We could not obtain a full data series for the number of wineries for each of the counties in every year. Therefore the covariate W_{ij} was obtained by imputing values for years other than 2013 and 1987 using a standard exponential growth curve. For the weather covariates, the missing Amador values were replaced with Sacramento values and the missing Marin values were replaced by the Sonoma values. Various alternative weather variables were considered including mean daily maximum temperatures, averages over periods other than Apr–Sept, ranges between max and min temperatures, etc. We settled on the covariates which provided the greatest statistical significance (i.e. lowest p-value). Other diagnostic procedures on the residuals also suggested model adequacy in terms of the normality assumption and the assumed variance structure on the error terms. The various data sources for the panel analysis were NASS, California Department of Agriculture, UC Davis IPM, US TTB, Cooke and Vilas (1989).

Table 2
Value of farm land and buildings/acre by CA county, 2007 ($).
Source: Author calcs from USDA, NASS.

San Fran	457,143	Stanislaus	9476	Solano	4934
Napa	27,122	San Mateo	9340	Glenn	4823
Ventura	22,782	Lake	9182	Amador	4764
Santa Cruz	22,423	Fresno	7927	Monterey	4645
San Diego	19,247	Butte	7513	Kern	4626
Sonoma	15,887	Nevada	7331	SLO	4546
Riverside	15,765	Merced	7210	Colusa	3979
LA	14,027	Santa Barbara	7081	Alameda	3878
Orange	12,095	Alpine	6851	Calaveras	3665
Placer	10,188	Del Norte	6800	Tuolumne	3398
San Joquin	10,168	Madera	6783	Tehama	3184
El Dorado	10,161	Sacramento	6721	San Bernadino	3167
		Contra Costa	6605	Shasta	3158
		Sutter	6559	Mono	3088
		State Ave	6408	San Benito	2787
		Yuba	5931	Sierra	2609
		Santa Clara	5719	Sisikiyou	2501
		Kings	5465	Humboldt	2458
		Yolo	5460	Plumas	1831
		Mendocino	5312	Mariposa	1649
		Imperial	5290	Modoc	1459
		Marin	5055	Lassen	1383
				Trinity	1244
				Inyo	951

5.2.1. Results

The model was significant with a $R^2 = 0.74$ and β_0 (intercept) = \$1214. An advantage of the panel analysis is that it allows us to account for the simultaneous effect of variables. Fig. 6 depicts the estimated county variables where we observe that Napa is one of the leading counties in terms of value per acre.

Fig. 7 depicts the estimated yearly effects in the panel analysis. We observe variation in the years with a general

Table 3
Average precipitation and temperature for California winegrape counties, 1981–2010.
Source: NASS, author calcs; range is max–min.

	Ave. annual precip (in)		Ave. annual temp (°F)	Ave. annual temp range
Mendocino	39.93	Kern	61.2	32.1
Amador	33.13	Lake	56.9	29.8
Sonoma	31.43	Kings	63.1	29
Lake	31.42	Madera	61.9	28
Sacramento	21.17	Tulare	65.5	27.4
Monterey	21.1	Sonoma	58.9	27.3
Napa	20.39	Merced	61.2	26.9
Yolo	19.6	Solano	62.9	26.9
San Luis Obispo	19.01	Yolo	61.2	26.8
Santa Barbara	17.76	Mendocino	59	26.7
San Benito	14.19	Sacramento	60.8	26.2
San Joaquin	14.06	San Joaquin	61.4	26.1
Stanislaus	13.11	San Benito	58.8	25.9
Kern	13.1	Fresno	64.2	25.6
Fresno	12.8	Napa	56.4	25.4
Merced	12.5	Stanislaus	63.7	24.8
Madera	12.02	San Luis Obispo	59.3	24
Tulare	11.22	Amador	60.4	22.8
Kings	7.55	Santa Barbara	59	19.6
Solano	6.12	Monterey	55.8	15.2

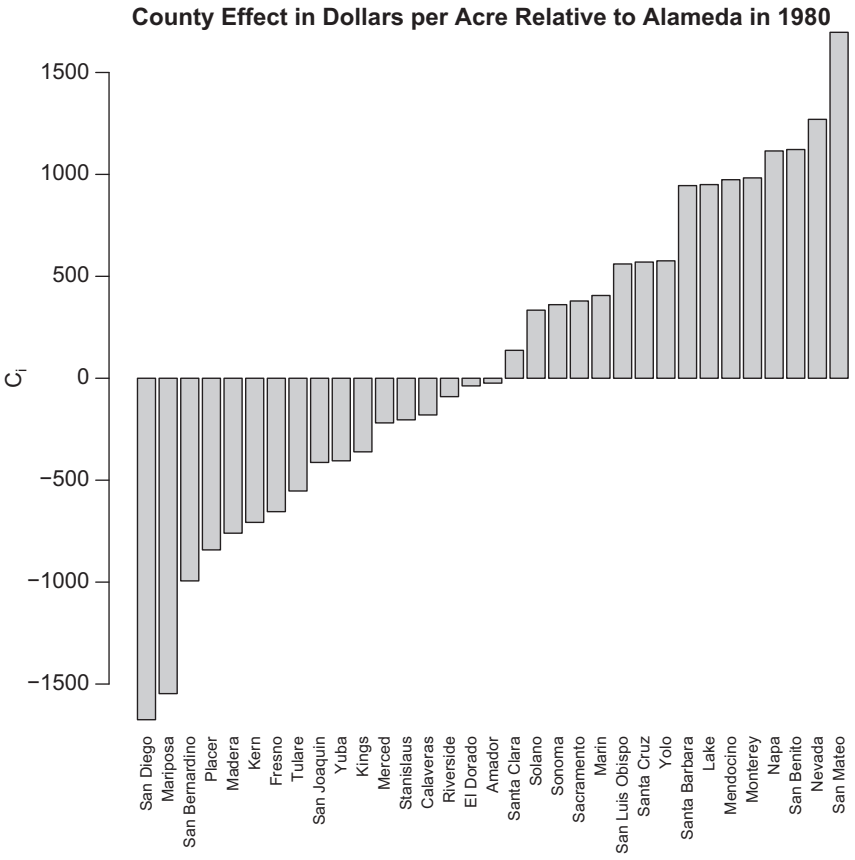

Fig. 6. County effects of econometric model.

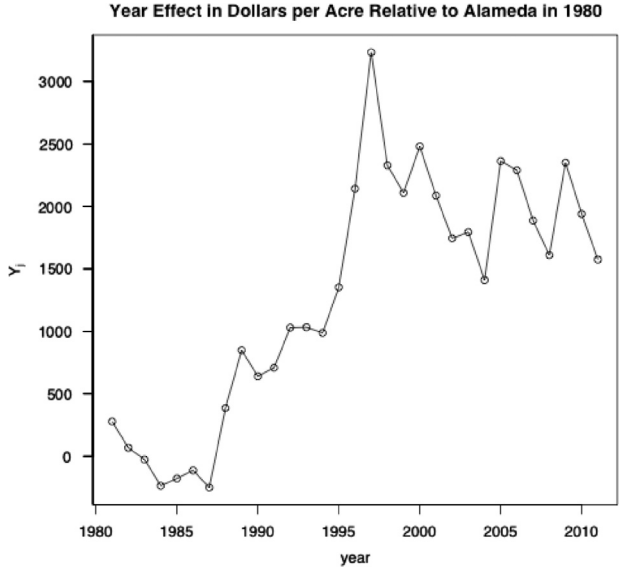

Fig. 7. Year effects of econometric model.

increase in dollars per acre over the period 1980–2011, and a dramatic rise during the decade 1987–1997. The year 1997 is notable in terms of a premium effect although 1997 does not seem particularly noteworthy when compared with the California vintage charts as seen on the eRobertParker.com website.

For the winery covariate W_{ij}, we obtained the estimated coefficient $\beta_1 = 8.83$ providing an interpretation that every additional winery in a county corresponds to an increase of $8.83 return per acre. The covariate was highly significant with a negligible p-value.

For the weather covariates, we obtained $\beta_2 = -68.02$ and $\beta_3 = -55.01$. The interpretation is that each additional inch of rain over the period April through September corresponds to a loss of $68.02 per acre. With respect to the mean daily minimum temperature, every drop of one degree Fahrenheit is associated with a loss of $55.01 per acre. The corresponding p-values for P_{ij} and T_{ij} were 0.010 and 0.067 respectively where the second p-value is borderline significant. An important point to consider is that these marginal effects due to weather are taken into account in the presence of the county covariates. And it is reasonable to assume that one of the things that is related to a county's value per acre is its typical weather patterns. Therefore the weather covariates take into account weather beyond the typical weather patterns. There is evidence, in sum, for *terroir* via weather playing a role.

5.3. Advantages deriving from proximity to markets and support institutions

The new economic geography focuses on economies of scale and proximity to consumer markets as sources of agglomeration. Locating clusters close to suppliers is a consistent claim of the new economic geography theory as well as Florida's creative class theory; evidently in natural resource regions this is an

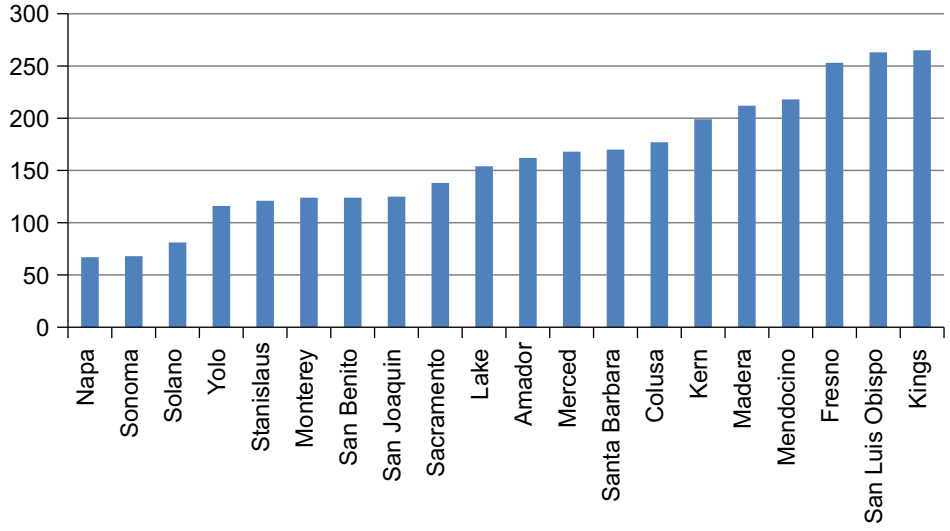

Fig. 8. Minimum distance to LA or SF (miles).

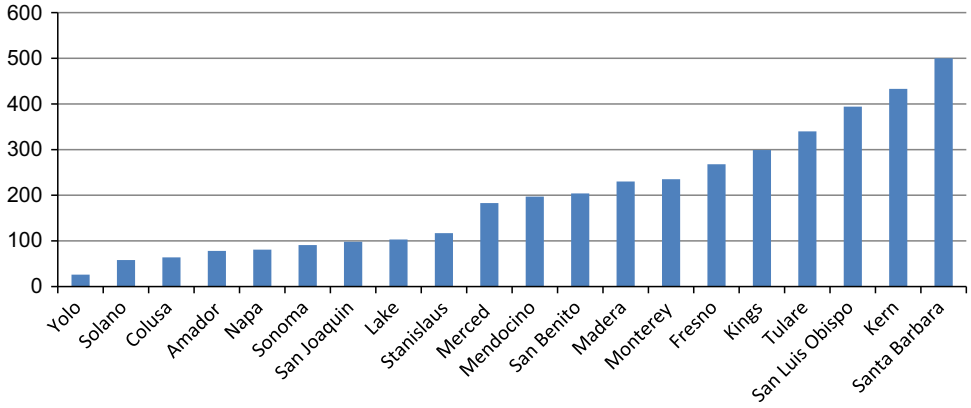

Fig. 9. Distance to Sacramento (miles).

advantage. However, grapes can be grown around the state of California. A huge part of the wine business is tourism, and therefore proximity to large urban markets should be a key factor, but we do not see advantages for proximity to Los Angeles playing out in prices or quality premia. Napa is closer to San Francisco than other clusters, but Sonoma is equally close yet lags in price. So, distance is a weak explanatory variable. Moreover, Solano is close, and Santa Barbara far to lifestyle/demand centers, yet one has low wine price values and the other higher ones (Fig. 8).

Cluster theory suggests proximity to support institutions is also valuable as it allows for improved and tailored policy support, as well as flow of personnel between the industry and policy support positions. There are several key support institutions for the California wine industry. The first is the California Wine Institute, which has combined lobbying, marketing, and market research functions for wineries. Its counterpart for grape growers is the California Winegrape Growers Association. The third is UC Davis, with its renowned Viticulture and Enology Department, which trains winemakers and conducts agricultural research. There are, of course, regional tourist promotion agencies in each wine region of the state. All three cluster institutions are located in Sacramento, the state capital, which is not far from Napa or Sonoma. However, some of the lowest quality and price producing counties are closer to Sacramento, while some of the higher quality regions, such as Santa Barbara and Monterey, are quite far (Fig. 9).

Cluster theory also suggests that proximity allowing for tacit knowledge transfer through face-to-face meetings is key to providing the knowledge flows that provide the agglomeration advantages to clusters. Locating support institutions in Sacramento does not make sense from this point of view, and implies that UC Davis is more involved in basic R&D and training and the other support institutions more involved in lobbying than knowledge diffusion on a personal level.

5.4. Conclusion—geographic advantages

We have seen thus far that comparative advantage is reversed when it comes to the wine industry; more expensive areas produce higher priced wines. This fits in with the general consumer notion that a more expensive wine must be better. We have found evidence that *terroir* in the form of different weather patterns can provide a partial explanation.

Table 4
AVAs by California county.
Source: Author calculations from US Government, Bureau of Alcohol, Tobacco and Firearms.

County	Number of AVAs	Average AVA Acreage		Number of AVAs	Average AVA acreage
Napa	16	208,587	Sacramento	5	145,368
Sonoma	14	297,694	Solano	5	618,772
Mendocino	10	324,016	Santa Barbara	4	296,880
Monterey	10	132,309	Amador	3	873,833
San Benito	8	324,087	Stanislaus	3	24,047
San Joaquin	8	102,788	Yolo	3	52,880
Lake	6	532,799	Fresno	1	230,000
San Luis Obispo	6	303,543	Madera	1	230,000

However, we cannot explain via weather why Napa enjoys a premium over Sonoma, with similar weather, or why other areas, including Sonoma, are able to produce individual wines that fetch similar or higher prices to Napa wines. Thus *terroir* is only a partial explanation. *Terroir* may limit the number of areas that can produce high quality wine, but it cannot predict which ones will. In fact, we can say with confidence that knowledge is needed to take full advantage of weather, and to adjust to weather changes. This would include everything from types of grapes to irrigation planning.

Moreover, comparative advantage in the wine industry does not come from production cost advantages in the other key inputs to producing wine grapes: land, and labor. Labor is more expensive in Napa as well, given the higher costs of living there. It is possible that there is a higher skill level in Napa, but that is not a function of natural comparative advantage. Rather it suggests more of a social capital and cluster multiplier effects.

6. H3, H4, H5

Advantages through entrepreneurship, global technology transfer, and social capital.

Two recent studies suggest that price premium for wine may have as much to do with regional reputation as *terroir*. That is, wine producers and consumers pay more for Napa because it is Napa, not for any clear objective difference in the wine itself (Gergaud and Ginsburgh 2010, Cross et al., 2011). This would be especially true for New World wine appellations, which are created by geography and application, usually just around the origins of the grapes themselves, rather than through any rigorous quality standards or varietal types. If we think about the fact that previously lower quality wine areas or non-productive areas such as Lodi, Santa Barbara, and Mendocino are now capable of producing the highest rated wines, a pattern mirrored throughout the world wine market from new producing regions, we can only reach one conclusion. Advances in technology have to a significant extent reduced the natural advantages of *terroir*. This makes sense if we consider the various scientific revolutions in winemaking over the past half century, from new irrigation systems to new strains of yeast.

Our analysis leaves us therefore with the search for explanations relating more closely to human agency, in terms of how the reputation for quality and the formal and tacit knowledge for fine winemaking were created within a region. We found in our model that as the number of wineries increases, so does the value of wine grapes, providing prima facie evidence of the importance of social capital. That is, when a wine district is dense, comparative advantage would suggest costs will go up, as land, labor and other inputs become more demanded. Cluster and social capital theory provide plausible explanations that density brings benefits, from labor and input specialisation to the easier sharing of tacit knowledge. It also brings the greater possibility of reputational capital, as more wineries see the benefit of collective action, and institutional creation and maintenance transactions costs lower, leading to the possibility for creating a strong regional brand.

6.1. Quantitative evidence for social capital

We can see some quantitative reinforcement for social capital based on the number and size of the American Viticultural Associations (AVAs). AVAs are designated by the Bureau of Tobacco, Alcohol, and Firearms of the US Government, and require local sourcing. They are created through a petition by local wineries, and thus are a good indirect proxy for the levels of local organization, as they require collective action which in turns means the consensus to develop a regional brand. Table 4 shows that Napa is clearly the most socially dense wine producing county in California, despite being just half the size of Sonoma.

In order to test these explanations further, we created a correlation matrix, using price/ton and value/acre as the dependent variables for the top 19 counties where wine was produced in 2011.

The correlation matrix shows that there are negative relationships between price/ton and yield/acre; the higher the yield, the less valuable the grapes, suggesting higher yield counties produce lower quality grapes. The number of AVAs and number of wineries correlates very highly with price/ton and value/acre, suggesting that more social capital, as represented by a higher number of AVAs in Napa, corresponds with higher values (Table 5).

We must recognize the limitations of the quantitative evidence. We cannot say precisely whether the higher prices in Napa attracted more winemakers, or if the social capital created the higher prices on this basis alone. Probably both fed off of each other, creating virtuous cycle of reciprocal growth. More importantly, we can clearly conclude from the evidence

Table 5
Correlation matrix for key variables.
Source: NASS USDA, Author calculations.

	Price/ton	*Value/acre*
Price/ton	1	
Value/acre	0.814	1
Total value	0.537	0.623
Yield/acre	−0.559	−0.066
Acreage	0.090	0.124
# Wineries	0.904	0.809
Size of AVAs	0.276	−0.100
# of AVAs	0.854	0.570
Distance to LA	0.380	0.254
To SF	−0.392	−0.272
To riverside	0.401	0.257
To San Diego	0.370	0.253
To Sacramento	−0.231	−0.176
To San Jose	−0.200	−0.124

that higher levels of social organization are associated with higher prices. Unfortunately, absent a new major survey of every wine region in California, there are no data that map out social networks in the industry. To further examine human agency as an explanation, we therefore turn to an historical analysis of the development of quality in the California industry.

6.2. *The quality revolution of California wines begins in Napa*

While Southern California was the center of the wine industry throughout the 19th and early 20th century, prohibition of alcohol from 1920 to 1933 sent the industry reeling. The recovery of the industry began in the Central Valley with the major gains by the Gallo company to create/take advantage of a mass middle class market that emerged in the postwar years. Gallo built their own winery on Dry Creek in 1936, producing bulk wine. In 1940, they began selling their own wine. They became famous for using modern techniques to produce wine of consistent quality, including long-term contracts with growers, and for aggressively promoting their brand nationally (Curry III, 1994, pp. 87–88, 249). Gallo had 3 Ph.D. scientists working on their team as chemists, ones who also experimented with creating new blends. Gallo was the first big winery to adopt a number of technologies, such as using a centrifuge to separate juice and solids, and a diffuser to recover alcohol and sugar from residue at the bottom of a press (Conaway, 1990, p. 122). Gallo came to dominate the jug wine market, including producing 65% of the wine in Napa and 50% of the state in 1956 (Guthey, 2012, p. 187).

A wave of large corporate investment came into California in the 1940s focused on Northern California wineries, including Seagram's purchase of Paul Masson. The investment was motivated by the federal order to convert all alcohol producing plants to wartime use. By 1943, four companies owned 17 wineries and 25% of storage capacity in the state Hutchinson 1969, p. 31). However, by 1953, dismayed by low returns, most had withdrawn from the field (Curry III, 1994, pp. 92–93). Yet in the 1950s, the industry underwent a crisis of oversupply of grapes and wine. As a result, the number of wineries in California declined from 364 bonded wineries in 1950 to 226 in 1967, reflecting a period of consolidation. By 1961, the three largest California wineries, including Gallo and United Vintners, controlled 60% of all California wine sold nationally (Lapsley, 1996, p. 138). A national survey in 1956 suggested that 85% of the wine was consumed by 15% of the population, largely aging immigrants who preferred jug wine and the rest looking for sweet wine with high alcohol content (Taber, 2005, p. 42). For the most part, the industry was marked by large volume production with grapes being blended from across different regions and more concerned about pricing and quality. There were no signs at this point of the coming explosion in demand for quality wine (Lapsley, 1996, pp. 143–145).

Given the Central Valley's cost advantages, it could have continued to dominate production, however by the 1960s, Napa began to emerge as a premium producer, a shocking development given the historical backdrop we have just described. According to historical analyses, there are several possible foundations for the shift of California wine towards quality production. The first is the leadership of the scion of the quality revolution in the California industry, Robert Mondavi, who was located in the Napa region. Cesare Mondavi, Robert's father, first purchased St. Helena winery in Napa in 1935 (by legend convinced by his wife at Robert's request) and then expanded to purchase Charles Krug winery in 1943. As General Manager of the Krug winery, Robert oversaw the transformation from bulk to proprietary wine using classic varietals. During his time at Krug, Mondavi pushed forward the idea of regional promotion through drumming up tourist visits, which numbered in the thousands by the 1950s, putting Napa on the list of "must sees" near the Bay area (Guthey, 2004, p. 130). This is fitting with Mondavi's idea that intensely personal and local marketing would create loyal customers, paving the way for imitators in the boutique wine revolution that followed (Siler, 2007, p. 28). Mondavi had an "epiphany" during a visit to France in 1962. He was the first winemaker to use cold fermentation, a technique pioneered in California. His brother, Peter, credits UC Davis with the research behind this breakthrough (Mondavi, 1990, p.19). In 1965, after continuing disputes with his brother, he developed his own winery, which was the first new winery in Napa in 30 years. He developed a striking Mission style architecture for the buildings. After winning a lawsuit against his brother in 1978, he was able to expand further (Curry III, 1994, pp. 260–261; Guthey, 2004, p. 125). Ironically, he states "Out of our terrible fight, though, came my liberation. Once I was put on leave at Krug, I was forced to rethink my entire direction in life" (Mondavi, 1998, p. 18). His decision was cemented when his son Michael was not given a post at Krug.

As Curry puts it (p. 262), "From the very beginning, Mondavi targeted the upscale market, vowing to create wines of elegance and sophistication. He sought knowledge and advice from wherever he could find it. He hired André Tschelistcheff, the highly honored winemaker at Beaulieu as a consultant, and sought advice from other Napa Valley fine wine pioneers such as John Daniel Jr. and Louis M. Martini."

He also followed around Inglenook winemaker John Daniel "like a puppy" (Guthey, 2004, p. 125). Mondavi therefore built upon the early scientific improvements of Napa Valley's quality oriented wineries who took advantage of and shared scientific breakthroughs developed during the 1930s, including Beaulieu, Inglenook, Larkmead, Barringer, L.M. Martini, and the Christian Brothers, "creating a larger concentration of higher-end producers of bottle wine than anywhere else in California. Ultimately, this critical mass of talent would combine with the nascent but emerging emphasis on varietal and geographic labeling to make Napa the best-known and most respected viticultural area in California" (Lapsley, 1996, p. 97). Curry notes how quickly these efforts paid off, with a Mondavi wine winning first prize at a statewide blind tasting test in 1972. Mondavi was part of a generation of winemakers that created a culture of quality "with near religious zealotry" (Warner, 2007, pp. 147–148). Mondavi personally saw the value in spreading knowledge throughout Napa (Curry III, 1994, p. 123). He traveled frequently to Europe and bought equipment there (Mondavi, 1985, p. 42).

On the other hand, Guthey (2004, p. 93) argues that the Mondavi and like stories are romanticized, and that the improvement of California wines has to be seen in a more evolutionary light, with foundations being laid much earlier. For example, California winemakers won awards at the 1900 Paris Exhibition and organized the International Congress of Viticulture in San Francisco in 1915 (Guthey, 2004, p. 98). These built upon the aforementioned statewide efforts at quality improvement dating back to the 19th century. Moreover, the work of scientists at UC Davis, such as Maynard Amerine and Albert Winkler, trained many winemakers from the 1930s to 1960s, including providing a series of how to manuals that were widely distributed. These included discussions about the interaction between climate and varietal, which was often ignored in the early years of their efforts (Lapsley, 1996, p. 48). Winiarski, among others, credits such efforts as providing an important foundation for their knowledge of winemaking (Taber, 2005, p. 99). Julio Gallo states that they were consulting with UC Davis scientists as early as the 1930s (Gallo and Julio, 1994, p. 80). Mondavi (1998, p. 87) also notes that Tschelistcheff worked closely with UC scientists.

Equally important is the tireless promotion of Mondavi and others to change perceptions among the American population about the quality of California wines compared to European ones. Mondavi (1998, p. 161) was on the road for about half the year for much of his career, engaged in promotion as well as learning new techniques and developing partnerships (such as the one with Baron de Rothschild). Napa producers engaged in a relentless and well-funded public relations effort, using advertising, promoting film location, developing the first set of well-organized wine tourism, developing the first wine festivals around the country, taking advantage of conventions in San Francisco, and creating a buzz in the media, among other efforts (Lapsley, 1996, pp. 147–148, 154–155). Such efforts go back at least to 1955 when the Premium Wine Producers of California was created as a trade organization to engage in a public relations campaign to promote the perception of quality within the US (Rodriguez, 2010, pp. 67–68). In 1968 dry table wines outsold sweet dessert wines in the US for the first time (Colman, 2003, p. 206).

From the 1970s, wine became synonymous with a prosperous and affluent lifestyle (Colman, 2003, pp. 245–247). This was quite a turnaround for a product previously most closely associated with immigrant dinner habits (Conaway, 1990, p. 242). A support industry around tourism and informing the public about quality supported these efforts, such as the reviews of Robert Parker and his counterparts around the country such as regular reviewers in *the Wall Street Journal, the New York Times and Financial Times*. Specialty magazines such as *Wine Spectator* linked wine to the good life, including reviews of restaurants, hotels and featuring as of luxury cars and watches.

While numerous competitions within California and the US assured a wide distribution of medal possibilities that wineries could claim, domestic wines were still considered inferior to Europe (Conaway, 1990, p. 190). White wine made from red grapes with minor tinting, called "blush" by marketers to reflect cheap, sweet, and cloying qualities, dominated the US market, outselling reds 3 to 1 as recently as 1981 (Conaway, 1990, p. 267). The development of California quality reds that could compete with the higher priced European wines was unforeseen at the time.

The key event in the history of the upgrading of California wines was the 1976 blind tasting in Paris, in which, for the first time, New World wines won a competition, namely a red and white wine from Napa Valley. As the most important wine critic, Robert M. Parker Jr., stated in 2001, "the Paris Tasting destroyed the myth of French supremacy and marked the democratization of the wine world. It was a watershed in the history of wine" (Taber, 2005, p. 211). It is interesting to note that André Tchelistcheff was partly responsible for getting the wine to the tasting (Conaway, 1990, p. 194). The results were confirmed in another blind tasting later that year. From this point, both acreage and returns on wine grape production grew significantly. *Time* Magazine, with 20 million middle-class readers, reported on the event. The *New York Times* also picked up on it, and it was featured in a weekly wine talk column that had begun four years before. After the article appeared, the featured wines were sold out across the country. The comparison also further pushed the industry towards higher quality, dry wines which had been championed by Mondavi (Rodriguez, 2010, p. 71; Taber, 2005, pp. 214–216). Another key reinforcement was the *60 min* 1991 story called the "French paradox" promoting the health benefits of red wine in moderation (Rodriguez, 2010, p. 78; Colman, 2003, p. 209).

6.3. Sonoma vs. Napa

Whereas Napa became home to boutique and high quality wines, Sonoma was developed more as an "industrial vineyard" with much larger acreage based on much cheaper land than Napa. Sonoma is closer to the coast, and therefore has a cooler climate lending itself to different varietals such as Pinot

Noir. Gallo purchased "vast tracts of land" in the 1980s, and was associated with environmental degradation for the transformation of the landscape around its property. The fight over development, as in Napa, led to control on the growth of wineries in the 1990s. It began to call itself Gallo of Sonoma to move up in quality perceptions. Kendall Jackson also moved in on a large scale (Guthey, 2004, pp.193–196; Conaway, 1990, p. 283). There are still a number of small Sonoma wineries, and they try to distinguish their supposedly laid back culture from that of Napa. This began to change as land prices in Napa pushed growth into Sonoma as a cheaper alternative for the newly wealthy from the 1980s. Both valleys have gone through different booms of wealth as their global profile increased, from Japanese investors in the 1980s to Silicon Valley boomers in the 1990s and 2000s (Deutschman, 2003, p. 138, 208). Patchell (2011, pp. 118–119) notes importantly that Napa is more compact, better organized, enjoys much easier access through better infrastructure to San Francisco, and has wineries that are laid out to create an easy to manage wine route. The Napa wine train further has increased the appeal and access to most wine tourists. Matt Kramer (1992, pp. 149–151) points to long-standing difference between the two regions, going back to the 19th century:

> Then as now, Napa Valley was where wealthy owners built show-off wineries. Sonoma County, in contrast, was where people went to farm…. Napa Valley boosters like to point to themselves as "keepers of the flame," noting such wineries as Beaulieu (founded in 1900) and Inglenook (founded in 1872), both of which managed to get through the 13 devastating years of Prohibition. Yet Sonoma County had its own survivors: Korbel (founded in 1862); Simi (founded in 1876); and Sebastiani (founded in 1904). Nothing about the quality of the land distinguishes Napa Valley from Sonoma County but something about the *lay* of the land does: The sheer sprawl of Sonoma County flavored its fate…. Perhaps more than any other element, it is Sonoma's "spirit of place" that best explains why it evolved so very differently from Napa Valley. The most obvious feature is size. Sonoma County is more than twice as large as Napa County: 1604 square miles, compared to Napa's 744 square miles. But size alone is not the cause of Sonoma's strikingly different spirit of place. Instead, it is the shape and feel of the landscape. In Napa Valley one has the feeling of being on display. It's narrow configuration is inherently public. Far from a detraction, it is this publicity that attracts-or at least lends itself to-a certain ostentation. The configuration of Napa Valley allows one literally to be "in society." It is this delicious confinement of landscape that was then, and still is today, the appeal of Napa Valley for wealthy outsiders. After all, why build a show-off winery (or house) if no one can see it? And wealthy newcomers to Napa Valley in the 1880s, or in the 1980s, had no intention of going unnoticed. In comparison, Sonoma County lends itself to assure privacy-almost to fugitiveness. You can get lost in Sonoma County, in every sense. In the Russian River Valley, the river twists on the ground like a landed fish. Each bend of the river is its own world, isolated in sight and sound from landfall of the neighboring bend.

Kramer (1992, p. 154) goes on to note that by highways, Sonoma is closely connected to Mendocino County. However the Mayacamas mountains present a formidable barrier even to this day for traffic between Sonoma and Napa.

6.4. Conclusion—entrepreneurship and social capital are the keys to industry success

Our historical analysis of the turn towards quality in the California wine industry reveals evidence for the importance of both entrepreneurship and social capital in the predominance of Napa. We also saw that global pipelines of knowledge through corporations are a highly limited source of cluster success. While corporations played an important role in capital injections via waves of investment, corporations cannot be tied to the technical progress in wine production. In fact, we saw that corporate interest in the wine sector has come and gone in waves. There is certainly a role of global knowledge transfer, but it comes via immigrant entrepreneurs, such as LaTour (founder of Beaulieu) and Tschelistcheff, the Russian immigrant, not corporations. *Entrepreneurship and social capital are factors which also distinguish Napa from other quality producers, particularly Sonoma, but also Santa Barbara, Mendocino, and Lodi, where efforts at local organization pale in comparison to Napa, despite the presence of large corporations throughout the state's wine production, including foremost Gallo of Sonoma.*

7. Conclusion

The obvious explanation for industrial location from the foregoing analysis is that Napa produces both higher quality grapes and wine, and it produces and maintains a reputation for consistently higher quality wine, including through marketing efforts. We have documented is that comparative advantage based upon natural resource endowments or location is only a small part of the story behind competitive advantage (Giuliani et al., 2005, p. 552). If the sources for quality are to only a limited extent from *terroir*, then they must but in good part created by human endeavor. Our research demonstrates that *terroir* is just a starting point for understanding how quality is created in wine; the rest depends upon human agency, particularly the efforts of entrepreneurs, to work together to develop the technological breakthroughs that give them a comparative advantage. Behind these breakthroughs and the development of a regional brand are social capital and institutions.

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